--(New Claim) 24. The X-ray tube subsystem of claim 1 wherein said X-ray tube produces ions and said grid collects said ions at said grid to eliminate effects of said ions on an electric field around said cathode.--

--(New Claim) 25. The method of claim 9 wherein said X-ray tube produces ions and said grid collects said ions at said grid to eliminate effects of said ions on an electric field around said cathode.--

--(New Claim) 26. The X-ray examination system of claim 14 wherein said X-ray tube produces ions and said grid collects said ions at said grid to eliminate effects of said ions on an electric field around said cathode.--

REMARKS

Claims 1-20 were originally pending, of which claims 1, 7-9, 14 and 20 were amended and to which claims 21-26 were added. It is respectfully submitted that the pending claims define allowable subject matter.

In the outstanding Office Action, the drawings are objected to under 37 C.F.R. 1.83 (a) as not showing every feature of the invention specified in the claims. The specification is objected to under 35 U.S.C. §112, first paragraph, as failing to provide an adequate written description and failing to provide an enabling disclosure. Claims 1-20 are rejected under 35 U.S.C. §112, first paragraph, for the reasons set forth in the objection to the specification. Applicants respectfully traverse the foregoing rejections and objections for reasons set forth hereafter.

It is respectfully submitted that the drawings and specification clearly describe where and how the ion collection voltage is applied separate in time from the focus voltage. The drawings clearly illustrate the grid voltage supply 124, the focus grid 120, and the cathode filament 118. The specification states, "The grid voltage supply 124 produces a positive ion collection voltage on the order of 10 to 30 volts at several milliamps." and, "During operation of the tube, the ion collection voltage is generated between the focus grid 120 and filament 118 to sweep positive ions out of the X-ray tube 110." The written description and drawings illustrate that the grid voltage supply 124, focus grid 120 and cathode filament 118 are used to perform the different functions at separate points in time. In particular, the specification clearly states that the grid voltage supply 124 and focus grid 120 are used for the function of ion collection by configuring the grid voltage supply 124 to apply a relatively low negative bias voltage to the focus grid 120 with respect to the cathode filament 118. The specification also clearly states that the grid voltage supply 124 and focus grid 120 are separately used to focus an electron beam by configuring the grid voltage supply 124 to apply a relatively intermediate negative bias voltage to the focus grid 120 with respect to the cathode filament 118. The grid voltage supply 124 and focus grid 120 are also described to be used to cut-off an electron beam from the anode by configuring the grid voltage supply 124 to apply a relatively high negative bias voltage to the focus grid 120 with respect to the cathode filament 118.

From the foregoing express teachings, it is respectfully submitted that the person of ordinary skill would understand that the grid voltage supply 124 is a variable voltage supply source to allow for any or all of the functions described above. In particular, the written description clearly states, "A focus grid voltage supply 124 (which may be a fixed or variable voltage supply) is connected between the focus grid and filament." Therefore, it is respectfully submitted that the means for supplying the ion collection voltage is clearly shown in the drawings as the grid voltage

supply 124 being connected between the cathode filament 118 and focus grid 120 and, therefore, the objection under 37 C.F.R. 1.83 (a) should be removed.

Further, it would be equally clear to the person of ordinary skill that a variable voltage source would be adjusted from a low voltage corresponding to an ion collection voltage to a higher voltage corresponding to an electron beam focus voltage. The specification provides exemplary ranges for both ion collection and beam focusing voltages and explains that both voltages may be supplied from a common source, namely, grid voltage supply 124. The artisan would certainly understand that, when a single variable voltage source is used to provide two different voltages, the two voltages would necessarily be applied at separate and appropriate times. Hence, it is respectfully submitted that the 35 U.S.C. §112, first paragraph rejection is improper and should be withdrawn.

Claims 1-20 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention as the claims are allegedly incomplete. While it is believed that the claims are not deficient, to facilitate prosecution the independent claims have been amended to address the issues raised by the Examiner. It is submitted that the amended claims were complete as originally presented and are complete now as well.

Claims 1-20 are rejected under 35 U.S.C. §103 as being unpatentable over Baptist (6259765 PCT published 12/98). It is respectfully requested that the rejection of claims 1-20 under 35 U.S.C. §103 be withdrawn since a prima facie case of obviousness has not been established. The outstanding Office Action only sets forth certain general teachings of Baptist in support of a general obviousness rejection of all of the pending claims 1-20. In the obviousness rejection, differences between the prior art and the claimed invention have not been identified. Also, no explanation has

been provided that would serve as a motivation to the artisan to modify the prior art in a manner that would render obvious the claimed invention. Also, no discussion is provided concerning the alleged obviousness of the features of the dependent claims, for example, the Faraday cage.

Further, it is respectfully submitted that Baptist does not teach or suggest the claimed invention. The claims generally concern an X-ray tube subsystem and method for operation thereof comprising a grid voltage supply connected to a grid bias connection where the grid voltage supply is adapted to produce an electron beam focus voltage and ion collection voltage at a grid where the ion collection voltage is substantially less than the electron beam focus voltage. When the ion collection voltage is applied to the grid, as opposed to the higher electron beam focus voltage, free positive ions that are created within the X-ray tube are swept away from the cathode filament (collected) by the grid to prevent high voltage breakdown events.

The prior art fails to teach or suggest structure or steps for creating/producing an ion collection voltage that is substantially less than an electron beam focus voltage. Nor does the prior art teach or suggest the claimed cathode filament in combination with an ion collection voltage.

Baptist is concerned with a method for creating an electron beam using an electron cathode source with at least one microtip (not a filament) and using an extraction grid and magnetic field to help form and focus the electron beam. Baptist does not teach or suggest a cathode filament or filament connection but instead describes a cathode microtip which substantially differs from a cathode filament. Baptist specifically teaches away from using a filament by stating "Furthermore, the structure of X-ray tubes with filaments does not make it possible to define any specific shape of the X-ray source, i.e. the zone of the tube from which the X-rays are emitted, in an accurate and controllable fashion." (column 3, lines 1-4). Also, Baptist does not teach or suggest collecting the positive ions or using a grid for ion collection. Instead, Baptist describes repelling or pushing the

positive ions away from a separate, dedicated grid toward the anode to keep the positive ions away from the cathode microtip. Baptist applies a voltage potential to the separate, dedicated grid that is higher (more positive) than the voltage potential of the extraction grid to achieve the repulsion of the positive ions away from the dedicated grid towards the anode. Baptist teaches that this voltage potential is the same polarity as the anode potential and may even be higher in magnitude than the anode voltage potential (column 6, lines 59-67; column 7, lines 1-6; and column 10, lines 12 –16). In view of the foregoing differences between the prior art and the claimed invention, it is respectfully submitted that the claims are neither anticipated nor rendered obvious by the prior art.

Moreover, it is submitted that the dependent claims are non-obvious. When the X-ray tube produces positive ions, they tend to aggregate around the cathode filament and have an undesirable effect on an electric field around the cathode filament. By applying a negative ion collection voltage to the grid (as in claim 2) in the range of 10 to 30 volts, these positive ions are collected (swept away) by the grid. Baptist does not teach or suggest an ion collection voltage and does not teach or suggest applying a negative voltage in the range of 10 to 30 volts to a grid. Calibration of the X-ray tube (as in claim 11) is accomplished by determining the optimum ion collection voltage that minimizes high voltage breakdown events. Baptist does not teach or suggest an ion collection voltage and does not teach or suggest calibrating an X-ray tube. When it is desired to perform electron beam focusing, a voltage of greater than 100 volts is applied to the grid (as in claim 3). Baptist does not teach or suggest applying a voltage to a grid for focusing an electron beam. The grid voltage supply can be susceptible to electromagnetic interference. A Faraday cage (as in claim 4) can be configured to surround the grid voltage supply to eliminate the unwanted interference. This is accomplished by connecting the Faraday cage to the filament bias connection. Baptist does not teach or suggest a Faraday cage. The voltage applied between the anode and cathode of the X-

ray tube is in the range of 100-150 kilovolts (as in claim 20). In column 6, lines 25-27 of Baptist, Baptist describes applying +5kV to +50kV between the anode and the microtip.

In view of the foregoing, it is respectfully submitted that the pending claims define allowable subject matter. A favorable action on the merits is respectfully requested.

Should anything remain in order to place the present application in condition for allowance, the Examiner is kindly invited to contact the undersigned at the telephone listed below.

Please charge any additional fees or credit overpayment to the Deposit Account of McAndrews, Held & Malloy, Ltd., Account No. 13-0017.

Respectfully submitted,
McANDREWS, HELD & MALLOY, LTD.

Date: December 12, 2001

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Appendix
(marked-up claims)

1. (Amended) An X-ray tube subsystem comprising:

an X-ray tube including a grid connected to a grid bias connection, a cathode connected to a filament bias connection, an anode connected to an anode bias connection; and

a grid voltage supply connected to the grid bias connection, the grid voltage supply adapted to separately produce an electron beam focus voltage and ion collection voltage at said grid, said ion collection voltage being [substantially] less than [an] said electron beam focus voltage.

7. (Amended) The X-ray tube subsystem of claim 6 wherein [the] a Faraday cage is connected to the filament voltage supply.

8. (Amended) The X-ray tube subsystem of claim 6 further comprising an anode voltage supply connected to the anode bias connection and a ground reference, and a cathode voltage supply connected to [the] an earth ground and the filament bias connection.

9. (Amended) A method for operating an X-ray system to reduce high voltage breakdown events, the method comprising:

providing an X-ray tube that includes a grid connected to a grid bias connection and a cathode connected to a filament bias connection; and

during X-ray tube operation, creating an ion collection voltage between the grid bias connection and the filament bias connection that is [substantially] less than an electron beam focus voltage, to sweep free ions out of the X-ray tube.

14. (Amended) An X-ray examination system comprising:

an X-ray tube including a grid connected to a grid bias connection and a cathode connected to a filament bias connection;

a grid voltage supply connected to the grid bias connection, the grid voltage supply adapted to produce separately an electron beam focus voltage and an ion collection voltage at said grid, said ion collection voltage being [substantially] less than [an] said electron beam focus voltage to sweep free ions out of the X-ray tube;

an X-ray detector positioned to receive the electron beam; and

readout electronics connected to the X-ray detector.

20. (Amended) The X-ray examination system of claim 14, wherein the X-ray tube operates under a tube voltage [substantially] in the range of 100-150kV, the electron beam focus voltage is greater than 100 volts, and the ion collection voltage is [substantially] in the range of 10 to 30 volts.